

REMARKS

Herein, the "Action" or "Office Action" refers to the Office Action dated May 20, 2003.

Applicant respectfully requests reconsideration and allowance of all of the claims of the application. Claims 1-35 are presently pending. Claim 22 is amended herein. No claims are cancelled herein. No new claims are added herein.

The Applicant expressly grants permission to the Office to interpret all pending claims of this application.

As requested in the Office Action, the missing IDS references "E" and "F" (listed on the IDS filed 8/27/2000) are included in a Supplemental IDS enclosed with this response.

Prior Art Status of References

Applicant does not explicitly or implicitly admit that any reference is prior art. Nothing in this communication should be considered an acknowledgement, acceptance, or admission that any reference is considered prior art.

Substantive Claim Rejections

Claim Rejections under 35 U.S.C. § 103

The Office Action rejects claims 1-35 under 35 U.S.C. § 103(a) as being unpatentable over prior art admitted by the applicant in the specification in the instant application, in view of Chang. Applicant traverses these rejections and asks that they be withdrawn and the case passed along to issuance.

The Office Action's rejections are based upon the following reference:

- *Chang et al*, U.S. Patent No. 6,515,508 (hereinafter "Chang").

Claims 1-9

Claim 1 recites an apparatus comprising [emphasis added]:

- a first device;
- a first connector, coupled to the first device;
- a second connector coupled to the first connector through a first plurality of conductors, wherein *alternating pairs* of conductors are reversed; and
- a second device coupled to the second connector through a second plurality of conductors.

In making out the rejection of claim 1, the Office Action states that the Applicant-admitted prior art does not disclose that *alternating pairs* of conductors are reversed. Applicant agrees. The Office Action then argues that it would have been obvious to have alternating pairs of conductors reversed in view of the disclosure of Chang. Applicant respectfully disagrees and traverses the rejection.

1 Chang teaches programmable logic device (PLD) circuitry in which
2 conductors in *each differential signaling pair* cross over one another at various
3 intervals in order to help reduce the adverse effects of capacitive coupling between
4 adjacent and parallel signaling paths (see Abstract). This is illustrated in Chang's
5 Fig. 14. Chang elaborates on Fig. 14 in column 9, lines 20-64, which is reproduced
6 below [emphasis added]:

7
8 FIG. 14 illustrates how certain portions of the interconnection
9 resources on PLD 10 (FIG. 1) can be constructed to help further
10 reduce the adverse effects of capacitive coupling between adjacent
11 interconnection conductors. FIG. 14 shows three representative
12 differential signaling paths on device 10. Each path includes two
13 conductors of any type(s) 50, 60, 70, 80, and/or 90. Each path is
14 shown extending from an associated differential driver 200 to an
15 associated differential receiver 300. The three paths 50/60/70/80/90
16 extend substantially parallel and adjacent to one another. For that
17 reason, parasitic capacitive coupling can be expected to occur
18 between the paths, especially between the conductors in two
19 adjacent paths that are closest to one another. This unwanted but
20 unavoidable capacitive coupling is indicated by the capacitor
21 symbols 500 in FIG. 14.

22 To reduce the adverse effects of capacitive coupling 500, the two
23 conductors 50/60/70/80/90 of *each differential signaling path* are
24 reversed (as shown in FIG. 14) at periodic intervals along the length
25 of the path. The interval length used in adjacent paths are preferably
different so that for at least some segments of each path the
capacitive coupling from the adjacent path(s) tends to be self-
cancelling. As shown in FIG. 14, for example, the conductors in the
top-most path reverse twice so that the top-most path is effectively
divided into three approximately equal-length segments. The same is
true for the bottom-most path. The conductors in the middle path,
however, reverse only once so that the middle path is effectively
divided into two approximately equal-length segments. Because the
middle path conductors reverse near the midpoint of the center
segment of the upper and lower paths, the capacitive coupling in
either direction indicated by elements 500b and 500c tends to be
self-cancelling. The same is true for capacitive coupling in either

1 direction indicated by elements 500f and 500g. It will be apparent
2 from consideration of FIG. 14 that capacitive coupling in either
3 direction indicated by elements 500a and 500d also tends to be self-
cancelling. The same is true for capacitive coupling in either
direction indicated by elements 500e and 500h.

4 The conductors 50/60/70/80/90 in *each differential signaling path*
5 in FIG. 14 are reversed by having one conductor cross over the other
6 conductor at each point of reversal. It may be convenient to refer to
conductors that are thus configured as "twisted."

7 Applicant respectfully submits that neither Chang nor Applicant-admitted
8 prior art teach or suggest that only *alternating pairs* of conductors be reversed. In
9 fact, Chang *teaches directly away* from Applicant's claimed subject matter by
10 specifically teaching that *each and every pair* of conductors be reversed.
11 Applicant-admitted prior art discloses no twisting of conductors whatsoever.
12 Accordingly, for at least this reason, claim 1 is allowable.

13 Claims 2-9 depend from claim 1 and, as such, are allowable as depending
14 from an allowable base claim. These claims are also allowable for their own
15 recited features which, in combination with those recited in claim 1, are neither
16 shown nor suggested by the references of record either singly or in combination
17 with one another.

18 Claims 10-14

19 Claim 10 recites an apparatus comprising [emphasis added]:

- 20 ○ a first integrated circuit including a plurality of differential drivers;
- 21 ○ a first connector coupled to the first integrated circuit;
- 22 ○ a second connector coupled to the first connector through a plurality
23 of electrical conductors, wherein *alternating pairs* of the electrical
conductors are reversed; and
- 24 ○ a second integrated circuit coupled to the second connector, wherein
25 the second integrated circuit includes a plurality of differential
receivers.

1 In making out the rejection of this claim, the Office Action argues that
2 claim 10 is rendered obvious by the combination of Applicant-admitted prior art
3 and Chang. However, as noted above, nowhere does Applicant-admitted prior art
4 or Chang teach or suggest that *alternating pairs* of the electrical conductors are
5 reversed. As noted above, Chang teaches directly away from any such subject
6 matter. Accordingly, for at least this reason, claim 10 is allowable.

7 **Claims 11-14** depend from claim 10 and, as such, are allowable as
8 depending from an allowable base claim. These claims are also allowable for their
9 own recited features which, in combination with those recited in claim 10, are
10 neither shown nor suggested by the references of record either singly or in
11 combination with one another.

12
13 **Claims 15-21**

14 **Claim 15** recites an apparatus comprising [emphasis added]:

- 15 • a printed circuit board;
- 16 • a plurality of connectors disposed on the printed circuit board;
- 17 • a first integrated circuit disposed on a first substrate, wherein the
18 first substrate is configured to be coupled to one of the plurality of
19 connectors;
- 20 • a second integrated circuit disposed on a second substrate, wherein
21 the second substrate is configured to be coupled to one of the
22 plurality of connectors; and
- 23 • a first plurality of electrical conductors coupled to the plurality of
24 connectors, wherein *alternating pairs* of conductors between
25 adjacent connectors have reversed polarity.

21 In making out the rejection of this claim, the Office Action argues that
22 claim 15 is rendered obvious by the combination of Applicant-admitted prior art
23 and Chang. However, as noted above, nowhere does Applicant-admitted prior art
24 or Chang teach or suggest that *alternating pairs* of conductors between adjacent
25

1 connectors have reversed polarity. As noted above, Chang teaches directly away
2 from any such subject matter. Accordingly, for at least this reason, claim 15 is
3 allowable.

4 Claims 16-21 depend from claim 15 and, as such, are allowable as
5 depending from an allowable base claim. These claims are also allowable for their
6 own recited features which, in combination with those recited in claim 15, are
7 neither shown nor suggested by the references of record either singly or in
8 combination with one another.

9
10 Claims 22-25

11 As amended, claim 22 recites an apparatus comprising [emphasis added]:

- 12 ◦ a first device having an associated first inductive coupling
13 coefficient; and
- 14 ◦ a second device coupled to the first device through a plurality of
15 electrical conductors, the second device having an associated second
16 inductive coupling coefficient, wherein the first inductive coupling
17 coefficient is *adjusted* to be substantially the same as the second
18 inductive coupling coefficient.

19 In making out the rejection of claim 22, the Office Action argues that the
20 subject matter of claim 22 is rendered obvious by the Applicant-admitted prior art.
21 Specifically, the Office Action argues that it would have been obvious that “if the
22 one skilled in the art used the first and second devices as the same type for driving
23 signals, they would inherently have the same inductive coupling coefficient.”
24 Applicant respectfully disagrees.
25

1 The Applicant discusses inductive coupling coefficients in the Applicant-
2 admitted prior art on page 3, lines, 1-8, of the specification. This excerpt is
3 reproduced below [emphasis added]:

4 In the example of Fig. 1, coupling noise is caused by inductive
5 coupling. This coupling corresponds to parasitic mutual inductance
6 which occurs due to the physical construction of the integrated
7 circuit packages and connectors in the system. In Fig. 1, the mutual
8 inductance is represented by inductive coupling coefficient K1, K2,
9 and K3. Since the two connectors 102 and 104 are the same, they
10 have the same inductive coupling coefficient (K2). The two
11 integrated circuit packages 100 and 106 are *different*, so they each
12 have a *different inductive coupling coefficient* (K1 and K3).

13 In the example shown in Fig. 1 and discussed above, the integrated
14 circuit packages are *different*. Therefore, the inductive coupling
15 coefficients are *different*. In this situation, i.e., when the devices are
16 different, with different inductive coupling coefficients, the subject matter
17 of claim 22 provides an *adjustment* of the inductive coupling coefficient of
18 the first device so that it is substantially the same as the inductive coupling
19 coefficient of the second device. This process is discussed in the
20 specification beginning at page 9, line 23, and continuing to page 10, line 9.

21 This excerpt is reproduced below [emphasis added]:

22 In a particular system, the receiver package (i.e., integrated circuit
23 306) has *more coupling* than the transmitter package (i.e., integrated
24 circuit 300). To provide the necessary symmetry, the coupling of the
25 transmitter package is *increased* (i.e., more coupling noise is
generated) to match the coupling of the receiver package. The
coupling coefficient of the transmitter package can be increased by
redesigning the package of the integrated circuit so that the coupling
coefficient of the transmitter package is substantially similar to the
coupling coefficient of the receiver package. For example, in a

1 typical integrated circuit package, crosstalk results from the
2 inductive coupling between bond wires. The inductive coupling is
3 proportional to the length of the bond wires, in which longer bond
4 wires have greater inductive coupling. Thus, the coupling
5 coefficient of the transmitter package can be increased by increasing
6 the bond wire length.

7 Applicant submits that claim 22, as amended, is allowable.

8 Claims 23-25 depend from claim 22 and, as such, are allowable as
9 depending from an allowable base claim. These claims are also allowable for their
10 own recited features which, in combination with those recited in claim 22, are
11 neither shown nor suggested by the references of record either singly or in
12 combination with one another.

13 Claims 26-31

14 Claim 26 recites a method comprising [emphasis added]:

- 15 ○ generating a plurality of differential signals;
- 16 ○ transmitting the plurality of differential signals through a first
17 connector and a second connector to a plurality of differential
18 receivers;
- 19 ○ reversing the polarity of *alternating differential signals* between the
20 first and second connectors; and
- 21 ○ reversing the polarity of *alternating differential signals* between the
22 second connector and the plurality of differential receivers.

23 In making out the rejection of claim 26, the Office Action argues that this
24 claim is rendered obvious by the combination of Applicant-admitted prior art and
25 Chang. However, as noted above, nowhere does Applicant-admitted prior art or
Chang teach or suggest reversing the polarity of *alternating differential signals*
between the first and second connectors, and reversing the polarity of *alternating*
differential signals between the second connector and the plurality of differential
receivers. As noted above, Chang teaches directly away from any such subject
matter. Accordingly, for at least this reason, claim 26 is allowable.

1 Claims 27-31 depend from claim 26 and, as such, are allowable as
2 depending from an allowable base claim. These claims are also allowable for their
3 own recited features which, in combination with those recited in claim 26, are
4 neither shown nor suggested by the references of record either singly or in
5 combination with one another.

6
7 Claims 32-35

8 Claim 32 recites a method comprising [emphasis added]:

- 9 ○ *modifying* a transmitter package such that the coupling coefficient of
10 the transmitter package is substantially the same as the coupling
11 coefficient of a receiver package;
- 11 ○ transmitting multiple pairs of differential signals using the
12 transmitter package; and
- 12 ○ receiving the multiple pairs of differential signals using the receiver
13 package.

13 In making out the rejection of claim 32, the Office Action argues that this
14 claim is rendered obvious by the Applicant-admitted prior art. Specifically, the
15 Office Action argues that it would have been obvious that “if the one skilled in the
16 art used the first and second devices as the same type for driving signals, they
17 would inherently have the same inductive coupling coefficient.” Applicant again
18 respectfully disagrees.

19 As noted earlier, Applicant submits that the mere fact that when the
20 inductive coupling coefficients are inherently the same and require no adjustment,
21 does not render obvious the claimed subject matter, which is designed for
22 situations in which the inductive coupling is *not* the same. In the latter situation,
23 the transmitter package is *modified* such that its coupling coefficient is
24 substantially the same as the coupling coefficient of a receiver package.
25 Accordingly, for at least this reason, this claim is allowable.

